Economics of Alternative Silage Systems

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Introduction

Concrete tower silos have been used on dairy farms for many years. Bunker silos are becoming more popular, particularly on larger farms, because they offer more rapid filling and emptying. Many bunkers are not covered though, which causes greater feed losses. Another option is bagged silage where silage is pressed and sealed in large bags. Most recently, baled silage has gained some popularity. Large round bales of wet hay are wrapped in plastic where they ferment. Quantifying the costs and benefits of alternative storage methods is not easy. Technology that performs well under one set of crop and weather conditions may not perform well at other times. Long term studies are needed over a wide range of conditions. Models such as DAFOSYM, developed and validated with limited experimental work, can be used to study system performance over many years of weather. Many alternative dairy systems have been modeled with DAFOSYM to determine their value to producers.

Materials and Methods

DAFOSYM is a simulation model of crop production and feed use on dairy farms and the return of manure nutrients to the land. This dairy forage system is simulated over many years of weather to determine long term performance and economics of alternative technologies and/or management strategies. By modeling several options on the same representative farms, those that provide maximum farm production or profit are determined. As an example of the use of the program, silage systems using either stave silos, uncovered bunkers, silage bags, or bale silage were compared. This was not intended to be an extensive comparison of these systems, but simply an example of how these storage systems compare on a typical farm.

The farm represented a typical farm in southern Michigan with 100 high-producing Holstein cows plus 85 replacement heifers. Feed rations were determined for two groups of heifers, a dry cow group, and three groups of lactating animals. A mobile mixing wagon was used to prepare total mixed rations for each animal group. Round bales of hay were self-fed and available as needed.

Essentially all forage and grain feeds required by the herd were produced from 120 acres of alfalfa and 150 acres of corn. Alfalfa was harvested using a four cutting harvest strategy with the first two cuttings harvested at a bud stage of development and the last two harvested in early bloom. Harvests began within 5 days of May 30, July 6, and August 20 for the first three cuttings and on October 15 for the fourth cutting. First, third, and fourth cuttings were harvested as wilted silage, and second cutting was baled in large round bales. Corn was harvested as silage and high moisture grain to fill the available silos, and additional corn was harvested as dry grain.

Results and Discussion

The type of storage affects harvest rates, forage losses, the nutritive value of feeds produced, and animal performance (Table 1). Greater loss in bunker silos reduces the alfalfa and corn silages available as feed. Nutritive changes affect the corn and protein supplements required to meet the herd energy and protein requirements. Nutritive loss in bunker silos causes a small drop in milk production, and the lower digestibility of this silage leads to slightly more manure to handle. Nutritive changes in bale silage influenced the nutritive content in manure which caused a slight increase in fertilizer use.

The silage system selected affects machinery use, production costs, and farm profitability. With bunker silos, harvest and feeding rates are a little higher which reduces machinery operating costs and the use of fuel and electricity. Storage costs are lowest for silage bags priced at $5/ton

DM of silage and highest for bales wrapped with plastic costing $20/ton DM of silage. The two bunker silos (40 ft. x 140 ft., $45,000 each) had a higher initial cost than the four stave silos (18 ft. x 70 ft., $19,500 each) which led to slightly higher storage costs. Labor cost was a little higher for the bunker silo due to an extra person needed to operate the packing tractor. Overall, the annual net return or profit of the farm was $13,500 greater using the bag silage system compared to stave silos. Use of uncovered bunker silos reduced net return by $14,500 per year. The bale silage system reduced farm net return $2,000 per year below that of the stave silo system.

Conclusion

The most economical silage system for the 100 cow dairy farm was a bagged silage method. Use of either stave silos or wrapped bale silage provided similar farm profits which were substantially less than those of bagged silage. The least profitable storage method was an uncovered bunker silo.

Table 1. Effects of silage storage method on feed use, annual costs, and annual net return of a 100 cow (270 acre) dairy farm producing corn and alfalfa silages.

Production or cost parameter	Units	Stave silos	Uncovered bunkers	Silage bags	Silage bales
Alfalfa hay production	ton DM	143	144	143	144
Alfalfa silage production	ton DM	345	302	362	341
Corn silage production	ton DM	291	277	308	290
High moisture corn production	ton DM	160	160	160	160
Corn grain production	ton DM	54	55	55	54
Alfalfa purchased (sold)	ton DM	(14)	31	(43)	(13)
Corn grain purchased (sold)	ton DM	29	47	8	36
Protein supplements purchased	ton DM	47	42	58	42
Average milk production	lb/cow	20,973	19,912	21,355	20,882
Manure production	ton	6,966	7,249	6,786	6,999
Field and feeding machinery cost	$	49,134	44,939	47,317	46,596
Fuel and electric cost	$	6,330	5,912	5,966	5,975
Feed and machinery storage cost	$	22,164	23,527	18,660	26,295
Labor cost	$	35,288	36,602	35,178	35,077
Seed, fertilizer, and chemical cost	$	13,935	13,991	13,873	14,260
Corn drying cost	$	1,019	1,021	1,021	1,019
Purchased feed and bedding cost	$	26,992	29,521	27,278	26,485
Animal and milking facilities cost	$	35,261	35,261	35,261	35,261
Livestock expenses	$	23,800	23,800	23,800	23,800
Milk hauling and marketing fees	$	18,501	17,565	18,838	18,421
Property tax	$	4,924	4,994	4,554	4,739
Total production cost	$	237,348	237,133	231,746	237,926
Milk, feed, and animal sale income	$	294,906	279,554	302,328	293,434
Net return to management	$	57,558	42,421	70,582	55,508